

**CABINET GORGE HATCHERY
ANNUAL REPORT**

ABSTRACT

The total number of kokanee trapped at Cabinet Gorge Hatchery was estimated at 1,163, of which 238 females yielded 98,050 green eggs. These eggs accounted for 0.7% of the yearly total of 14,155,995 green eggs. The remaining 99.3% were received from Sullivan Springs. Survival to release was estimated at 83.0%, resulting in 11,743,000 fry weighing 27,072 pounds being released in June and July.

In February, 2,028,849 eyed kokanee eggs were received from Glenwood Springs Hatchery in Colorado. Of the total 1,849,028 released, 1,639,000 were planted in Priest Lake, and the remainder were planted into Lucky Peak Reservoir.

On April 22 and June 21, a total of 22,172 Gerrard-strain Kamloops were released into the Clark Fork River after being marked and imprinted with morpholine. In March, 30,150 eyed Gerrard-strain Kamloops eggs were received from Kootenai Trout Hatchery, British Columbia. During June, another 3,900 fry were received and combined with the other group. These are currently being reared at Cabinet Gorge Hatchery.

Of the 31 adult bull trout trapped at Cabinet Gorge Hatchery, only 6 were spawned. Three females were crossed with three males to yield 15,000 eggs. Poor survival during incubation resulted in a release of 2,109 fingerlings, of which 100 were ad-clipped and planted into Cedar Creek, and the remainder were ad-clipped and imprinted with morpholine before release at the hatchery ladder.

A total of 64 female Chinook salmon from Lake Coeur d'Alene were spawned providing 202,075 eggs. Of those, 89,900 eyed eggs were shipped to Mackay Hatchery for rearing and subsequent stocking back into Lake Coeur d'Alene.

Brown trout trapping in Twin Creek resulted in 6,262 green eggs from two female fish. These eggs were taken to Clark Fork Hatchery.

A total of 36,119 eyed westslope cutthroat eggs were received from Anaconda Hatchery in Montana during June and July, and are currently being reared for a potential broodstock source.

INTRODUCTION

Cabinet Gorge Hatchery is located in Bonner County, Idaho, approximately 8 miles southeast of the small community of Clark Fork. Recently constructed in 1985, the hatchery produces advanced-stage late-spawning kokanee salmon fry for Lake Pend Oreille (Table 1). These fry are needed to mitigate for the loss of wild kokanee recruitment caused by hydroelectric power projects on the Pend Oreille watershed. The hatchery also controls timing of the release of these fish to coincide with the altered cycles of zooplankton blooms in the lake by Mysis shrimp.

This year, the hatchery also produced Colorado kokanee salmon, pure Gerrard-strain Kamloops trout, bull trout, westslope cutthroat trout, and collected eggs from fall chinook salmon, and brown trout.

Staffing at the hatchery includes two permanent personnel, one temporary year long maintenance craftsman, 8.5 months of bio-aide time, and another 9.5 months of temporary time. Housing accommodations include two residences for the permanent staff and crew quarters for seasonal employees.

Water Supply

Cabinet Gorge Dam is located about one mile upstream from the hatchery. After its completion in 1952 and the resultant water level rise, artesian springs began appearing along the river at the present site of the hatchery. The hatchery utilizes these springs by pumping up to 20 cfs of water to the hatchery using six pumps in two well fields. The lower spring and upper well field vary inversely with each other over a 12-month period (Figure 1). A mixture of the two water sources allowed incubation water to be kept around 10°C (50°F). Early rearing water was also tempered during feed training and ranged from 4.4°C (40°F) to 11.1°C (52°F) (Figure 2).

Rearing Facilities

fish ladder. Unfortunately, the fish have to be hauled from the trapping
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Rearing facilities at the hatchery include 192 upwelling incubators measuring 12 inches in diameter and having a capacity of 150,000 eggs per incubator. There are 64 concrete raceways which have a rearing space of 32,000 cubic feet. Approximately one-third of the area of these is enclosed by the hatchery building. The adult holding area contains three holding ponds (10ft x 30 ft each). A trapping area (10 ft x 20 ft) is provided at the head of the area to the adult holding ponds to be spawned.

Table 1. Kokanee requested and produced.

Species & size	Production goal	Actual production	Percentage of goal achieved
Kokanee fry	20,000,000	11,743,000	59%

^aEgg take was 54.0% of requirement for full production.

MONTHLY RAW WATER TEMPERATURES

Oct. 1, 1988 thru Sept. 1, 1989

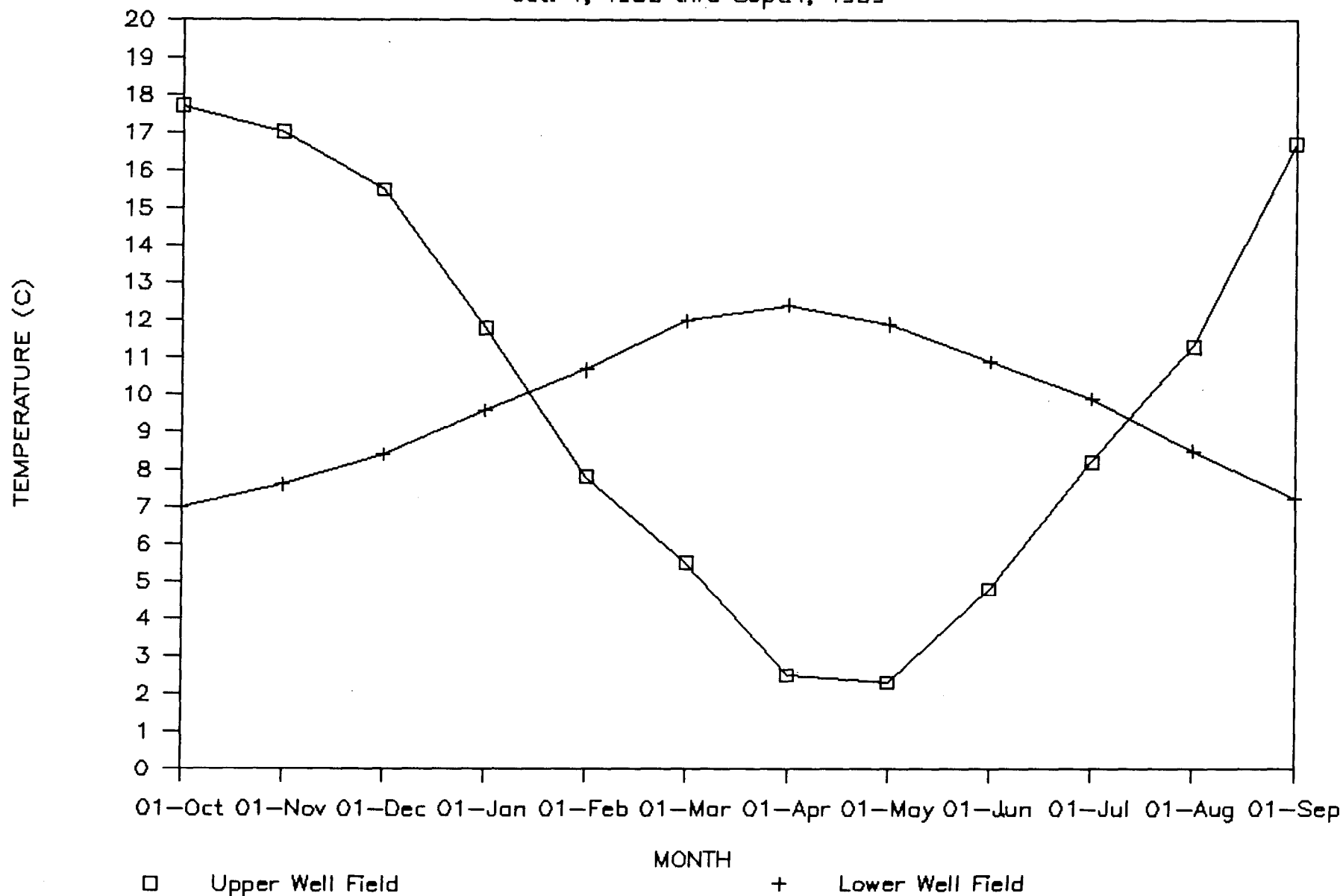


Figure 1. Temperature profile of different water sources at Cabinet Gorge Hatchery, 1988-89

PRODUCTION AND INCUBATION TEMPERATURES

Oct. 1, 1988 thru Sept. 1, 1989

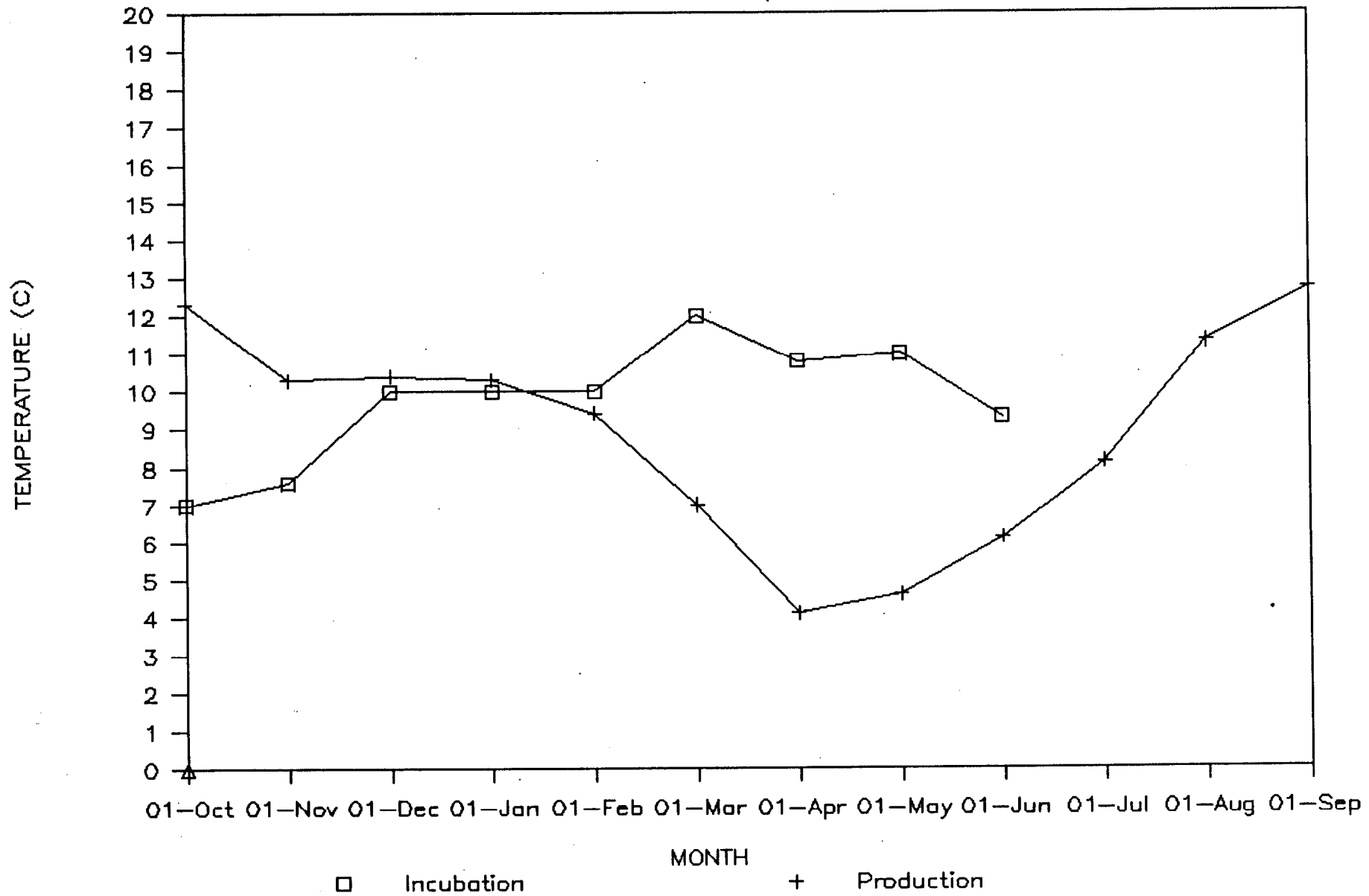


Figure 2. Temperature profile of water used in fish production at Cabinet Gorge Hatchery, 1988-89.

PRODUCTION

Between October 1, 1988 and September 30, 1989, Cabinet Gorge Hatchery released a total of 13,616,309 fish weighing 32,486 pounds (Table 2). On hand on September 30 included 23,156 Gerrard Kamloops and 34,063 Westslope cutthroat trout, weighing 514 pounds combined.

A total of 40,752 pounds of feed produced 31,575 pounds of gain, for a conversion of 1.29 overall. Average cost per pound of feed was \$.488, resulting in a feed cost per pound of fish of \$.61. Total production cost (less capital outlay) was \$189,643, resulting in a cost per pound of fish of \$5.84 and \$13.93 per thousand (Table 3).

Pend Oreille Kokanee

Survival of green eggs to feeding fry was estimated at 88.7% (1987-88, 88.2%). Survival from first feeding to release was estimated at 94.0% (1987-88, 92.3%), resulting in survival from green egg to release of 83.0% (1987-88, 81.3%)(Table 4).

A total of 11,743,000 kokanee fry were produced at an average length of 1.96 inches and an average weight of 2.27 pounds per thousand, or 441 fish per pound. These fish gained 26,603 pounds from 33,222 pounds of feed, resulting in a conversion rate of 1.25:1 (Table 5). Fish feed production cost was \$.476 per pound and \$1.35 per thousand.

Fish Trapping

The Cabinet Gorge fish trap was in operation from the middle of September to the beginning of December, 1988. Kokanee began entering the trap at the end of October, with the last kokanee trapped and spawned November 29, 1988. Trapping yielded a total of 1,163 late-run kokanee (20% females and 80% males) (Table 6). Prespawning mortality of females was 5.5% compared to 1987 figures of 7.4%.

Spawntaking and Eggs Received

Kokanee spawntaking began on November 3 and continued to January 5. The spawning operations peaked in early December at Sullivan Springs and early November at Cabinet Gorge Hatchery (Figure 3).

A total of 14,057,945 green kokanee eggs were received at Cabinet Gorge Hatchery during the 1988-89 production year. Of those, 98,050 were collected from 238 female kokanee at Cabinet Gorge Hatchery, and the remaining 13,959,895

Table 2. Production summary, all species, 1988-89.

Species (OH)	Released On hand	# R or OH	Lbs R or OH	Length	Fish/lb	Food fed to date	Ave. feed cost/lb (including freight)	Conv.	Production cost	cost/lb of fish
Pend Oreille kokanee	R	11,743,000	87,072	1.96	441	33,222	0,476	1.25	161,197	5.95
Colorado kokanee	R	1,849,028	3,247	1.3-3.6	2,250-70	4,847	0,476	1.72	9,482	2.92
Gerrard rainbow	OH	23,156	368	3.41	63	625	0,500	1.7	474	1.29
Gerrard rainbow	R	22,172	1,523	5.5	15	1,736	0,483	1.14	1,422	0.93
Westslope cutthroat	OH	34,063	146	2.31	233	171	0,470	1.23	1,896	12.99
Bull trout	R	2,109	130	5.6	16	151	0,963	1.15	4,741	36.47
Bull trout eggs	OH	0	---	---	---	---	---	---	3,793	N/A
Chinook salmon eggs	R	89,179	---	---	---	---	---	---	2,845	31.90/1000
Chinook salmon eggs	OH	89,500	---	---	---	---	---	---	3,793	42.38/1000
TOTALS	R	13,616,309	31,97			39,956	0,478	1.27	176,842	5.53
	OH	57,219	<u>514</u>			<u>796</u>	<u>0.970</u>	1.55	2,370	<u>4.61</u>
	eggs OH	89,500							7,586	
	eggs R	89,179	32,48			40,752	.488		<u>2,845</u>	5.52
Total Hatchery Operations Cost minus Capital Outlay									189,643	

Table 3. Production costs at Cabinet Gorge Hatchery, 1988-89.

Budget Class	Dollars	Cost per lb	cost per 1000
Personnel	76,703	2.40	5.61
Utilities	42,053	1.31	3.08
Supplies	29,766	.93	2.18
Government overhead	24,935	.78	1.82
Maintenance	6,086	.19	.44
Vehicle	3,801	.12	.28
Communication	3,746	.11	.27
Other	2,552	.08	.19
Total Operating ^a	189,643	5.92	13.87

^aActual production cost through November 1989 was \$198,138, or 7.8% above allocated costs. This increase was mainly due to an increase in utilities (pumps) and fish feed cost.

Table 4. Survival summary, kokanee salmon, Cabinet Gorge Hatchery, 1988-89.

Lot #	Number green eggs	Survival		
		Green egg to first feeding	Green egg to release	Feeding fry to release
SS1	1,207,006	.90	.87	.97
SS2	2,471,514	.91	.86	.94
SS3	2,452,174	.89	.84	.95
SS4	2,495,220	.91	.87	.95
SS5	2,431,352	.89	.81	.90
SS6	3,000,684	.83	.76	.92
CF1	98,050	.91	.89	.97
Total	14,156,000	.887	.83	.94

Table 5. Kokanee production summary, Cabinet Gorge Hatchery,
1988-89.

Lot #	Number produced	Pounds produced	Pounds per 1000	Feed fed	Weight gain	Conv.
SS1	1,048,600	2,375	2.37	2,756	2,182	1.26
SS2	2,116,500	5,315	2.22	6,053	4,898	1.24
SS3	2,069,100	4,175	2.25	5,366	3,773	1.42
SS4	2,160,800	4,365	2.08	5,659	3,947	1.43
SS5	1,965,700	3,874	2.11	5,932	3,473	1.68
SS6	2,295,100	6,272	2.10	7,208	5,817	1.24
CF1	87,200	229	2.58	247	213	1.16
Total	11,743,000	26,603	2.20	33,222	24,302	1.25

CABGORT1

Table 6. Late-run kokanee trapping at Cabinet Gorge Hatchery, 1988-89.

Month	Total		Males		Females		Prespawning Female Mortality
	1988	(1987)	1988	(1987)	1988	(1987)	1988 (1987)
Nov	1,163	(3,218)	900	(1,942)	263	(1,276)	25 (18)
Dec	0	(1,219)	0	(573)	0	(646)	0 (125)
Jan	0	(0)	0	(0)	0	(0)	0 (0)
Total	1,163	(4,437)	900	(2,515)	263	(1,922)	25 (143)

KOKANEE EGG TAKE

Sullivan Springs, 1988-89.

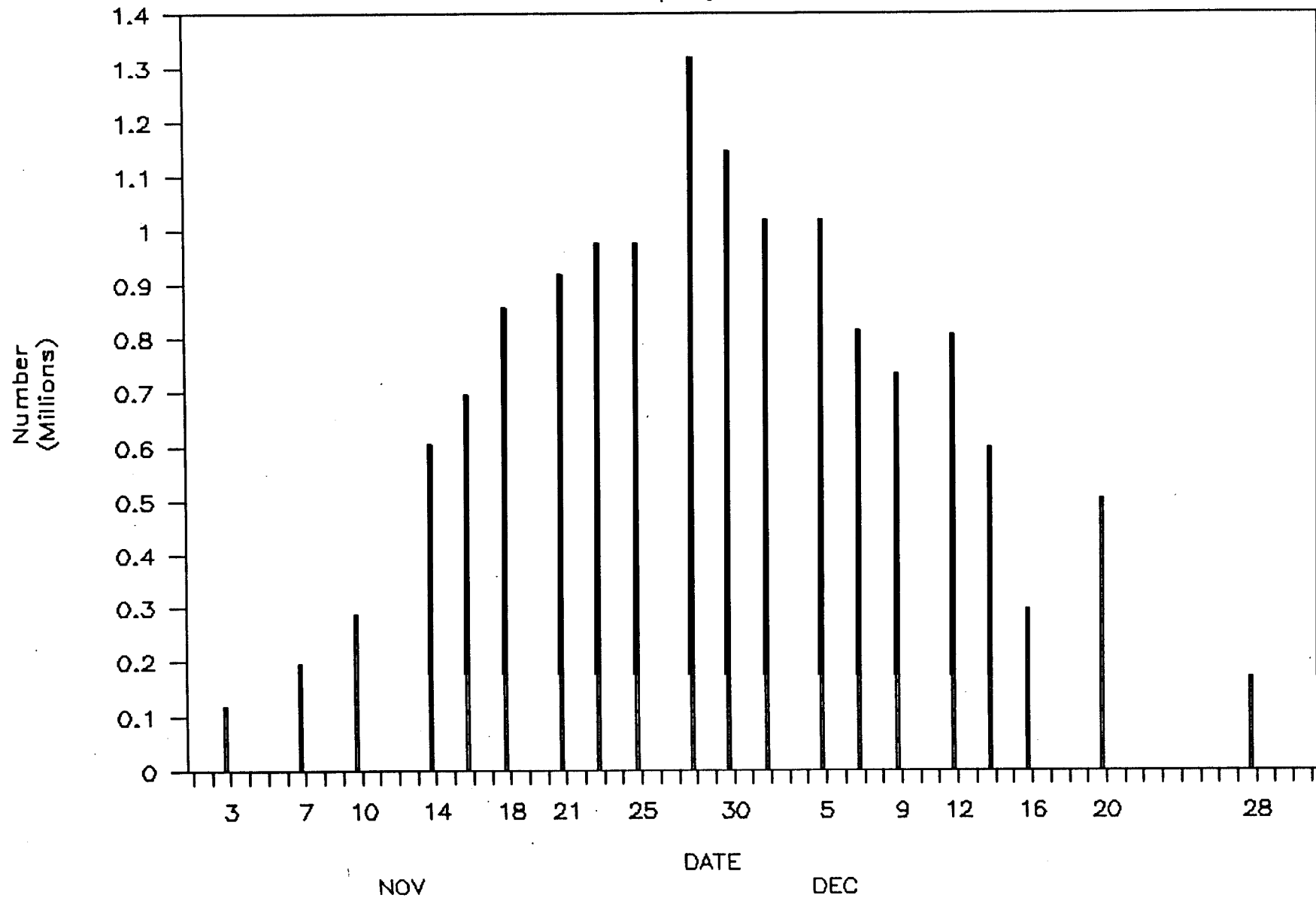


Figure 3. Kokanee egg take by date, Sullivan Springs, 1988-89.

were received from the Sullivan Springs trap. About 5,000 kokanee were placed above the trap to spawn naturally and assure a future egg source.

Spawntaking Projections

From research estimates of hatchery fry, survival to fall recruitment estimates of year-class strength can be quantified (Table 7). Following the individual year-classes through time with some assumed survival rates can predict year-class strength for spawning escapement. This method is crude and only reflects the potential egg-take based on year-class strength. However, it does provide basic trend information on how the rehabilitation effort is progressing.

Trawling by research personnel indicated poor survival (16%) on 1+ age kokanee. Kokanee at this size are difficult to evaluate, but if this estimate is accurate, the figures in parenthesis in Table 7 should be used. Next years trawling information will reveal more on this year class.

This projection uses the following assumptions:

- 45% survival from 0+ recruit to 1+
- 65% survival from 1+ to 2+
- 65% survival from 2+ to 3+
- 75% survival from 3+ to 4+
- 13% exploitation as 3+
- 13% exploitation as 4+
- 14% mature as 3+
- 86% mature as 4+
- 400 eggs per female
- 1:1 sex ratio
- 15% of lake escapement return to Sullivan Springs

Clark Fork River

- Only hatchery-released fish return to the ladder
- 100% trapping efficiency on morpholined hatchery release fish.

All six release groups were marked (Table 8). The Clark Fork River, Clark Fork River barge, and the Sullivan Springs releases had represented sample groups fin-clipped. The barge (open north and Clark Fork) and shoreline-south release groups were marked with Terramycin (TM100) fed at 5.5% of feed weight for ten days. The TM100 mark was used as a mass mark on the three release groups to provide a double check for an otolith mark that is laid down naturally at the time of release.

Table 7. Projected potential egg take, by location, in Lake Pend Oreille, 1990 - 1992 (numbers in millions).

	1990	1991	1992
Cabinet Gorge			
Age 3+	1.6	4.2 (1.52) ^a	3.0
Age 4+	Ob	7.34	19.6 (6.98)
Total	1.6	11.54 (8.86)	22.6 (9.98)
Sullivan Springs.			
Age 3+	2.85	1.8	3.12
Age 4+	7.56	13.14	8.31
Total	10.41	14.94	11.43
Grand Total	12.01	26.48 (23.8)	34.03 (21.41)

^aBased on low (16%) survival of one-plus fish.

^bDoesn't include pre-hatchery returns

Table 8. Differential marks applied to different release groups of kokanee fry produced at Cabinet Gorge hatchery, 1988-89.

Release date	Release site	# Fish released	TM100	Percent marked	Fin Clip		
					Ventral		adipose
					left	right	
June 21	CFR-CG	3,513,000		1.1	X		
June 29	Open North	1,256,000	X	100.0			
July 17-20	Barge CFR	984,000	X	100.0		X ^a	
July 11-13	SS	3,538,000		1.1			X
July 26	Open South	1,428,000		0.0			
July 27-28	Shoreline S.	1,024,000	X	100.0			
		11,743,000					

^a40,000 (4.1%) of these were also right-ventral fin-clipped.

A total of 40,000 Clark Fork River-released fish were marked with a left ventral fin clip, 40,000 Sullivan Springs-released fish were marked with an adipose fin clip, and 40,000 of the Clark Fork River barge-released fish were marked with a right ventral fin clip.

The ventral clips versus the adipose clip will be used to estimate the rate of adult straying between the Clark Fork River returns and the Sullivan Springs returns. The left ventral versus the right ventral clip will be used to evaluate adult return rates of hatchery release versus barge release in the Clark Fork River.

Fish Liberations

During June, 1989, 3,513,000 fish were liberated from Cabinet Gorge Hatchery into the Clark Fork River, and 1,256,000 were released into the north end of Lake Pend Oreille near Warren Island. In July, 6,974,300 were liberated from Cabinet Gorge Hatchery. Of these, 3,538,000 were released in Sullivan Springs, 984,000 were barged down the Clark Fork River and released at the in Pend Oreille Lake, 1,428,000 were released into the south end of Pend Oreille Lake offshore from Bayview, Idaho, and 1,024,000 were released offshore at the south end of the lake at Farragut State Park boat ramp (Table 9).

Numbers at release were based upon egg inventory number minus mortality. All numbers were checked with a weight/sample count number, except the hatchery ladder release. All egg/mortality inventory numbers were below (average 6.8%) weight/sample count numbers. Therefore, we believe the hatchery release number is accurate.

Kokanee in the Clark Fork River releases and the Sullivan Springs release were imprinted with morpholine at 5×10^{-5} ppm for three days prior to, during, and two days after release.

Clark Fork River

Two fry release strategies were conducted for research evaluation, of optimal hatchery-released fry survival in Pend Oreille Lake. A spring release utilized flushing flows (greater than 30,000 cfs) and a mid-summer release utilized a barge. Barged fry reached the lake in 150 minutes, while liberated fry began arriving approximately 180 minutes after initial release. One outmigration of kokanee fry is essential for the successful rehabilitation of kokanee for Cabinet Gorge Hatchery because of the predator trap in the Clark Fork River delta area.

Table 9. Late Kokanee liberation from Cabinet Gorge hatchery,
July 1989.

Date	Release site	# fish released	Total pounds	Length inches	No./ Lb.
Clark Fork River and Sullivan Springs					
June 21	Cabinet Hatchery	3,513,000	6,131	1.80	573
July 17-20	Clark Fork barge to Lake Pend Oreille	984,000	2,199	1.94	447
Subtotal--	Clark Fork River	4,497,000	8,333	1.83	540
July 11-13	Sullivan Springs	3,538,000	8,475	2.02	417
Subtotal--	Sullivan Springs	3,538,000	8,475	2.02	417
Pend Oreille Lake					
June 29	Open Water, North	1,256,000	2,657	1.81	473
July 26	Open Water, South	1,428,000	4,431	2.21	322
July 28	Shoreline, South	1,024,000	3,179	2.16	322
Subtotal--	Pend Oreille Lake	3,708,000	10,267	2.06	361
TOTAL	Pend Oreille Drainage	11,743,000	27,072	1.06	441

Hatchery Release

The hatchery release fry were flushed, using the fish by-pass system, directly into the ladder. Only three raceways were released at any one time to prevent fry from washing against the settling pond deflector screens before entering the by-pass pipe system. The entire release took less than one hour. Tempering was unnecessary as hatchery production and the Clark Fork River water temperatures were both near 8°C.

Clark Fork River Barge

The Clark Fork River barge release group was transported by research personnel using two 6-foot diameter circular tanks. Variation of water volume between tanks was necessary for proper weight distribution on the barge, with tank capacities of 1,010 and 1,300 gallons of water. Fry loading was done using hatchery production water transferred through 240 feet of 1/2-inch PVC pipe that ran out of the hatchery building down to the barge. Loading densities ranged from 0.14 to 0.16 pounds per gallon (D.I. range 0.52-0.60) while transporting.

River water temperature and olfactory tempering were accomplished using a pedestal type sump-pump. The pump delivered water (10 gpm per tank) via a spray bar which tempered the water from 10°C to 17.5°C in approximately 120 minutes. The fish also received supplemental oxygen through carbon stones in the tanks. Each tank had an oxygen bottle and regulator. The tanks were covered with plywood lids to reduce fish stress during transportation.

Fish were liberated from the tanks by removing the screens and drain standpipes and discharged with the water through the drain lines.

Tanker Hauling

The open waters, shoreline south, and the Sullivan Springs releases utilized the 10-wheel, 2,100 gallon, Corps of Engineers tankers. Some modifications were made to the tankers for hauling small fish. The agitators were completely closed off to prevent trapping fish inside, and the sight tubes for water displacement readings were also removed. The lids were equipped with weather stripping for a tighter seal.

Loading densities of small fish in the tankers ranged from 0.39 to 0.62 pounds per gallon (D.I. 1.5-2.3), with an average load density of 0.44 pounds per gallon.

Open Water Releases

Open water releases were accomplished by driving a 10-wheel, 2,100-gallon tanker onto a work barge, and pushed out into the lake with a tug boat. The open-north release utilized a private barge that was hired from Cramer Construction, Hope, Idaho. The late open-south release utilized a barge that was donated for use from the Navy base at Bayview. Tanker loads were tempered in three 20-minute cycles using a gas-powered 2-inch trash pump during transportation out to open water.

Sullivan Springs

Tanker access into Sullivan Springs is limited. Fish were planted above the bridge on the access road to the Idaho Department of Fish and Game (IDFG) patrol cabin. Fish were piped using 60 feet of 8-inch rigid discharge hose and 20 feet of collapsible hose. The collapsible hose was attached in the middle of the hose assembly and functioned to slow the discharge velocity during planting. Two tankers made up to two trips per day for three consecutive days to complete the plant.

It is recommended that, prior to release, a tanker load of water be used to scour out a fry release pool.

Shoreline South

Tankers accessed the shoreline south release at Farragut State Park's boat ramp. Sixty feet of 8-inch rigid discharge hose and 40 feet of 8-inch PVC pipe coupled with 10 feet of collapsible hose were assembled to discharge fry from the boat dock. Research expects better fry survival can be obtained if the fry are released at night away from structure-orientated predators. Three tanker loads in two consecutive nights completed the plant.

Other Fish Produced

Colorado Kokanee

In February, 2,028,849 eyed Kokanee eggs were received from Glenwood Springs Hatchery in Colorado. These eggs were disinfected in a 1:150 concentration of buffered Argentyne for ten minutes before being placed in upwelling incubators. The eggs were collected from wild fish in Granby Reservoir and showed negative results for bacterial and viral pathogens by the United States Fish and Wildlife Service (USFWS) Disease Control Center in Fort Morgan, Colorado. These fish were reared under the short-term excess hatchery

capacity clause in the Cabinet Gorge Hatchery operational agreement with Washington Water Power (WWP) and Bonneville Power Administration (BPA).

Survival of eyed-egg to initial feeding was estimated at 98.2%, resulting in 1,987,061 feeding fry. Survival from feeding fry to release was 93.1%, resulting in 1,849,028 fish being released. Of this total, 1,639,000 fry weighing 2,257 pounds and averaging 1.76 inches, were stocked into Priest Lake on July 7. A total of 5,010 fry were transferred to Hagerman Hatchery and another 150,200 fry, weighing 202 pounds and averaging 1.62 inches, were planted into Lucky Peak Reservoir on June 21. A final release of 55,018 fish, weighing 786 pounds and averaging 3.6 inches, were stocked into Lucky Peak Reservoir on September 28. This resulted in an excellent survival of eyed-eggs to release of 91.1%.

These fish received 4,847 pounds of feed to produce 2,812 pounds of gain for a conversion of 1.72:1. The production cost to rear 1,849,028 fish was \$9,482, or \$2.92 per pound and \$5.13 per thousand. Fish feed cost averaged \$.476 per pound.

Gerrard Rainbow

For the last two years, Cabinet Gorge Hatchery has been receiving pure Gerrard-strain Kamloops eggs from Kootenay Trout Hatchery in Wardner, British Columbia, Canada, to establish a pure-strain spawning run up the Clark Fork River and eventually returning to Cabinet Gorge Hatchery. This will result in an improved trophy Kamloops fishery in Lake Pend Oreille and lead to the elimination of supplemental stocking by Clark Fork Hatchery of "non-pure" Gerrard Kamloops.

These Kamloops were divided into two groups: a "coolwater" and a "warmwater" group. The coolwater group represents groups that achieve growth comparable to Gerrards in the wild. The other group is being reared on warmer water to achieve an earlier returning adult, thus providing eggs one year earlier than its wild counterpart.

1988 Gerrard

A total of 22,172 F2 Gerrard-strain Kamloops were released into the Clark Fork River on April 22 (warmwater group) and June 21 (coolwater group). Prior to release, the coolwater group was marked with a left maxillary clip and adipose fin clip, while the warmwater group received a right maxillary clip and adipose fin clip. These marks will allow hatchery personnel to evaluate survival and separate pure from non-pure returning adults. Both groups were imprinted with morpholine at .00005 ppm for three days before release.

Survival from eyed-egg to release was 84.8%. A total of 1,736 pounds of feed was fed to produce 1,514 pounds of gain, for a conversion of 1.14:1.

Production cost for these fish was \$1,422, resulting in a cost per pound of fish of \$.93 or \$.064 per fish.

1989 Gerrard

During March 1989, 30,150 F2 Gerrard-strain Kamloops eggs were received from Kootenay Trout Hatchery. The eyed eggs were disinfected in 1:150 buffered Argentyne for ten minutes and then placed in upwelling incubators. On June 20, another 3,900 fry were received and reared separately until the groups were split. Survival to initial feeding was estimated at 74.9%, resulting in 25,488 feeding fry.

These fish were split on July 27, and by September 30, the slow group averaged 2.92 inches, while the fast group averaged 4.05 inches. Food fed through September 30 totaled 625 pounds and produced a gain of 368 pounds, for conversion of 1.75:1 (Table 2).

Bull Trout

A bull trout program has been established at Cabinet Gorge Hatchery to advance the knowledge of bull trout culture and provide bull trout fingerlings to fisheries managers for reestablishment of enhancement of populations in Idaho.

A total of 31 adult bull trout were trapped during mid-September, 1988. However, 25 of these were released unharmed back into the Clark Fork River. Spawning occurred on September 23 and 29. Three females were crossed with three males two the first day and one the second), yielding 15,000 green eggs. Survival to eye-up was poor (42%) (Table 10). Survival from eyed-egg to swim-up fry was equally poor (41%). However, once they were buttoned-up, mortality rates declined to .2% per day for the next three months. Survival from fry to release was excellent (98%), resulting in 2,109 fingerlings averaging 5.6 inches and 16 fish per pound at release. About 100 ad-clipped bull trout were stocked into Cedar Creek by Clark Fork Hatchery personnel. The remaining 2,009 were released at the hatchery ladder after being ad-clipped. All bull trout were imprinted with a two-day morpholine drip followed by a two-day drip into the fish ladder effluent.

Two major sources of mortality are identifiable in bull trout production at Cabinet Gorge Hatchery. They are:

- 1) 58.3% infertility loss (green to eyed-egg)
- 2) 58.7% embryo mortality (eyed-egg to button-up fry)

The infertility loss is believed to be caused by low sperm counts from dry males. Male bull trout are ripe upon collection, but "dry up" in a matter of

Table 10. Bull trout survival data, 1988-89.

	Green Eggs	Eyed Eggs	Swim-up Fry	Fingerling (3.0")	Release (5.6")
Number---->	15,000	6,250	2,580	2,150	2,109
Green egg Survival to:		.417	.172	.143	.141
Eyed egg Survival to:			.413	.344	.337
Button-up Survival to:				.833	.817
Fingerling Survival to:					.981

days when held in the concrete holding ponds. This problem is recognized in Canadian Dolly Varden culture (Brown 1984). Consequently, unless male bull trout are collected when the females are ripe, collection of quality sperm from males is difficult.

The embryo mortality is attributed to high water temperatures during incubation. Brown (1984) and McPhail and Murphy (1979) found 39°F (4°C) during incubation produced the highest survival of Dolly Varden Salvelinus malma during incubation. Because the water temperature here is on a gradual warming trend during incubation and cannot be cooled, perhaps eyed eggs should be shipped to another hatchery where water temperature would be more conducive to rearing bull trout.

Chinook Salmon

Cabinet Gorge Hatchery is responsible for the spawning of fall chinook salmon in Lake Coeur d'Alene. Once the eggs have eyed-up at Cabinet Gorge Hatchery, they are shipped to Mackay Hatchery where they are hatched and reared until they are stocked back into Lake Coeur d'Alene. This year, a total of 64 females were spawned between September 14 and October 12, 1989. Of these, one was green, seven were spawned out, six were half spawned out, and four had overripe or bloody eggs which had to be discarded. The remaining females yielded a total of 202,075 green eggs (Table 11). A total of 89,900 (44.5% eye-up) eggs were shipped to Mackay Hatchery. The Von Bayer method of egg enumeration was used on these eggs.

This was the first year that rolling green chinook eggs was tried. Because of the poor quality of the eggs, plus their large size, rolling was very difficult and probably contributed to the poor eye-up. It is recommended that these eggs be placed in Heath trays in the future.

These eggs were water-hardened in Argentyne and again disinfected in Argentyne before entering the hatchery building. These eggs were isolated from the other fish in the building, and the raceways were chlorinated once the eggs were removed. Ovarian fluid and tissue samples were sent to Eagle Lab. Results were negative for BKD and viral pathogens.

Brown Trout

Cabinet Gorge Hatchery maintained and operated a weir and fish trap on lower Twin Creek, a tributary to the Clark Fork River, from October 25 through December 31, 1988. The trap was placed in the culvert under the railroad tracks on private property owned by Ruen Farms.

The objective of this trap was to inventory and obtain eggs from wild brown trout that were reported to be using Twin Creek for spawning habitat. The

Table 11. Summary of Wolf Lodge chinook spawntaking in September and October, 1989.

Date	Egg/oz.	Total ozs.	Total eggs	Number female	Egg per Female	Number males
9/14	72	400	28,800	7	4,114	7
9/18	72	165	11,880	3	3,960	5
9/21	72	194	13,950	4	3,488	8
9/25	78	403	31,430	6	5,238	13
9/29	78	45	3,510	1	3,510	1
10/4	92	190	17,480	4	4,370	7
10/9	90	490	44,100	12	3,675	20
10/12	97	525	50,925	10	5,093	24
Total/ ave.	83.8	2,412	202,075	47	4,300	85

progeny will be returned to Twin Creek in an attempt to enhance numbers of returning adult fish.

Two female brown trout yielded a total of 6,262 green eggs, an average of 3,131 eggs per female (Table 12). These eggs were taken to Clark Fork Hatchery for incubation and rearing.

Westslope Cutthroat

During June and July, 36,119 eyed eggs were received from Anaconda Hatchery in Montana. After disinfecting in Argentyne, these eggs were placed in upwelling incubators. Initial feeding began on August 5, 1989. Survival to initial feeding was estimated at 94.7%, resulting in 34,200 feeding fry. As of September 30, 1989, 34,063 fish remained, weighing 146 pounds and averaging 2.31 inches in length. A total of 171 pounds of feed was fed to produce 146 pounds of gain, for a conversion of 1.23:1. These fish are being reared as a potential broodstock source and will be transferred to a renovated lake in July, 1990.

FISH HEALTH

All eggs were certified disease-free or disinfected in Argentyne before entering the hatchery. The bull trout had no disease certifications performed; therefore they were isolated in the adult holding ponds where they were spawned and reared. All intra-state programs were certified by the Eagle Health Lab, Idaho Department of Fish and Game (Table 13).

Sullivan Springs Kokanee

Annual brood stock inspection of Sullivan Springs kokanee tested negative for all obligate pathogens. These results are consistent with previous years' results from this egg source. Annual kokanee fry inspection revealed a basophilic, VEN-like inclusion body in one sample. All other viral and bacterial pathogens tested negative.

Kokanee fry did experience episodes of increased mortality during the 1988-89 fish year. Late winter's "plugged gut," probably resulting from rapidly decreasing water temperatures, continued to be a source of mortality. A treatment of Epsom salt at 3% of the diet for three consecutive days, followed by two days off feed, was effective in treating the condition. This treatment was used to prevent possible outbreaks in raceways showing early symptoms of the syndrome. Bacterial Gill Disease (BGD) was diagnosed in one raceway by hatchery personnel this spring. Pathological investigations detected motile rods in gill tissue. A treatment of 8.4 ppm Diquat for three consecutive days reduced (84%) mortality back to normal over a six-day period. Subsequent raceways showing BGD symptoms were treated with Diquat or Chloramine-T before clinical outbreaks

CABGOR89

Table 12. Summary of brown trout spawning at Twin Creek trap, 1988.

Date	# females	# males	Total eggs
11/29	1	1	2,218
12/16	1	2	4,044
Total	2	3	6,262

Table 13. Fish health summary, Cabinet Gorge hatchery, 1988-89.

	Sample Dates	VH	VP	VE	BK	BR	BF	PW	PC
Adults									
SS kokanee	12-16-88	-	-	x	-	x	x	x	-
WL chinook	9-21-89	-	-	+ ^b	-	x	x	+ ^a	-
Fry									
SS kokanee	6-10-89	-	-	+ ^b	-	-	-	x	x
BC gerrard	4-14-89	-	-	-	-	-	-	x	x
	4-18-89								
Eyed Eggs Received									
BC gerrard	4-30-89	-	-	x	x	x	x	x	x
CO kokanee	12-14-88	-	-	-	-	-	-	-	x
MON C2	5-23-89								
(Westslope)	5-24-89	-	-	-	-	-	-	-	x

^aMyxobolus spores observed in 1 five fish sample pool using digest procedures but could not be confirmed by histological examination, not cerebralis.

^bEIBS+ = ven-like inclusions.

+ Positive results
 - Negative results
 x Not sampled

VH=IHNV, infectious hematopoietic necrosis virus
 VP=IPNV, infectious pancreatic necrosis virus
 VE=EIBS, erythrocytic inclusion body syndrome virus
 BK=bacterial kidney disease
 BR=enteric red mouth
 BF=bacterial furunculosis
 PW=whirling disease agent, Myxobolus (Myxosoma) cerebralis
 PC=Ceratomyxa shasta, agent of ceratomyxosis

CABGORT1

could occur. Both treatments proved effective in reducing bacterial gill related mortalities. Mortalities caused by "plugged gut" and bacterial gill disease episodes claimed less than 2% of the fish inventory.

SPECIAL STUDIES

An alternate method of fungus control for kokanee eggs was tested for the second consecutive year at Cabinet Gorge Hatchery. Approximately 3.6 million green eggs from Sullivan Springs were placed into upwelling incubators. One-half of the incubators were not treated with the usual 1:600 formalin treatments. Instead, the flow was adjusted up to a level so the eggs were at a point of just rolling. Evaluation of survival-to-hatch was compared to the incubators that were treated with formalin (control) (Table 14).

For the second consecutive year, it is evident that the technique of rolling eggs performs as well as, or better than, formalin-treated eggs. In addition, this method costs nothing, avoids the risk of human exposure to formalin, reduces labor, and will not effect returning adult kokanee to the ladder. Therefore, no formalin will be ordered for the 1989-90 production year.

Table 14. Results of alternative fungus control experiment at
Cabinet Gorge Hatchery, 1988-89.

Formalin Control			Roll Test		
Green eggs	Sac Fry	Percent Survival	Green eggs	Sac fry	Percent Survival
1,830,069	1,661,141	90.8	1,848,452	1,706,509	92.3

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